

Genetics
Learning Set 2.4
Punnett Squares and Probability



Practice: For each *genotype* below, write whether it is *heterozygous* (He) or *homozygous* (Ho)

Bb _____ *Ww* _____ *Dd* _____ *AA* _____ *ii* _____ *Cc* _____ *kk* _____

For each genotype write the **phenotype**.

Round seeds are dominant to wrinkled seeds.

RR _____ *Rr* _____ *rr* _____

Brown eyes are dominant to blue eyes.

BB _____ *Bb* _____ *bb* _____

Answer the questions below with the partner next to you.

Predict:

If you had two true-breeding tall pea plants, what percentage of the offspring would be tall pea plants?

Would it be possible to predict what percentage of the offspring of two heterozygous tall plants would also be tall?

Read page 61 & 62 as a class:

Exploration 1: Cross two homozygous parents

- In Learning Set 1, you looked at several traits in your classmates. One trait was attached or detached ear lobes. This trait has two alleles, one for detached ear lobes and one for attached earlobes.
 - Scientists know that detached ear lobes are dominant and a capital (D) is used to represent this allele. Attached ear lobes are recessive and it is represented by (d).
1. Record the genotypes of the parents across the top and left side for the other parent. Scientists call this the **p generation**.
 2. You will cross **two homozygous parents**. One for **attached** ear lobes and one for **detached** ear lobes to see what kind of ear lobes their children could have.
 3. Cross the two parents. The first offspring is called the **F1 generation or filial**. Filial means son or daughter in Latin.

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- a. What are the possible genotypes of all the offspring? _____
- b. What are the possible phenotypes of all the offspring? _____
- c. What percentage of offspring would probably have detached ear lobes? _____
- d. What percentage of offspring would probably have attached ear lobes? _____

Exploration 2:

Cross a heterozygous parent and a homozygous recessive parent.

- Another inherited trait in humans is a widow's peak. The allele for a widow's peak, W is dominant over the straight hairline (w).
- Use the Punnett square below to show the possible results of a **heterozygous** parent for a widow's peak (Ww).
- The other parent is **homozygous** recessive (ww) for straight hairline.
- Use the Punnett square to complete the possibilities of what the children might have.

	_____	_____

- What are the possible genotypes of the offspring? _____
- What percentage of offspring of these two parents would probably be homozygous for widow's peak? _____ What type of hairline will they have? _____
- What percentage would be heterozygous? _____ What type of hairline will they have? _____
- What percentage would probably be homozygous recessive? _____ What type of hairline will they have? _____
- What percentage of the offspring from these two parents would probably have the phenotypes of widow's peak? _____

Exploration 3: Cross a heterozygous parent and a homozygous dominant parent

Blight is a disease of rice caused by bacteria. It is good for rice plants to be resistant to blight. Resistance to blight is dominant. Make the letter (B) for resistant to blight.

- Cross two plants that are resistant to blight. One plant is heterozygous, the genotype is _____. The other plant is homozygous, the genotype is _____.

Use Punnett Square to cross these two plants.

- What percentage of the offspring would probably be resistant to blight? _____
- What percentage of the offspring would probably be homozygous? _____
- What percentage of the offspring would probably be heterozygous? _____

2. Next, cross the offspring of the F1 generation. How many Punnett squares will you need? Why?

3. Perform the crosses required to fill in each Punnett square. This is the F2 generation.

- a. What are the possible genotypes of the offspring? _____
- b. What fraction of the offspring of the F2 generation would probably be homozygous of the dominant allele?
_____ Will they be resistant to blight? _____
- c. What fraction would probably be heterozygous? _____ Will they be resistant to blight? _____
- d. What fraction would probably be homozygous recessive? _____ Will they be resistant to blight? _____

Reflect

1. What mathematical principle did Mendel use to predict the outcome of genetic crossing?
3. If you were to fill out the Punnett square, where would you put the two parent alleles (genotype)?
4. What is the benefit to using a Punnett square?